

2018-H: Gas leak via stuffing box

An oil/gas leak occurred from a closed valve connected to the equalise/blowdown manifold in connection with repressurising a well following a routine check of the downhole safety valve.

One of the causes was that the stuffing box did not conform with requirements. It contained only moulded packing rings instead of a combination of moulded and braided rings. In addition, the direction of rotation was inaccurately marked on the valve – the symbols showed (incorrectly) that the handwheel should be rotated clockwise when both opening and shutting the valve. Moreover, the correct direction of rotation was the opposite of normal practice. About a month before the incident in question, the valve was closed instead of being opened. In that connection, both valve and gearbox were subject to excessive torque. This probably caused the valve stem to get bent.

The relevant valve was supplied before the internal requirements on braided rings were introduced. However, it had spent several years in store before being installed and brought into operation in 2018. The fact that the stuffing box lacked braided rings went unnoticed at that time.

During the incident in question, the stuffing box was subject to pressure during equalisation against a common manifold pipe. The operator, who was standing about 20 metres from the leak site, reacted to a noise, assumed that a leak had occurred, and closed the valve he was opening. The leak reached the alarm limit on two line-of-sight gas detectors located directly above/below the leak point, and activated first automatic ignition source disconnection in the area and then a production shutdown. The leak has been estimated at 0.4 kilograms per second, with total gas escape of 71 kilograms.

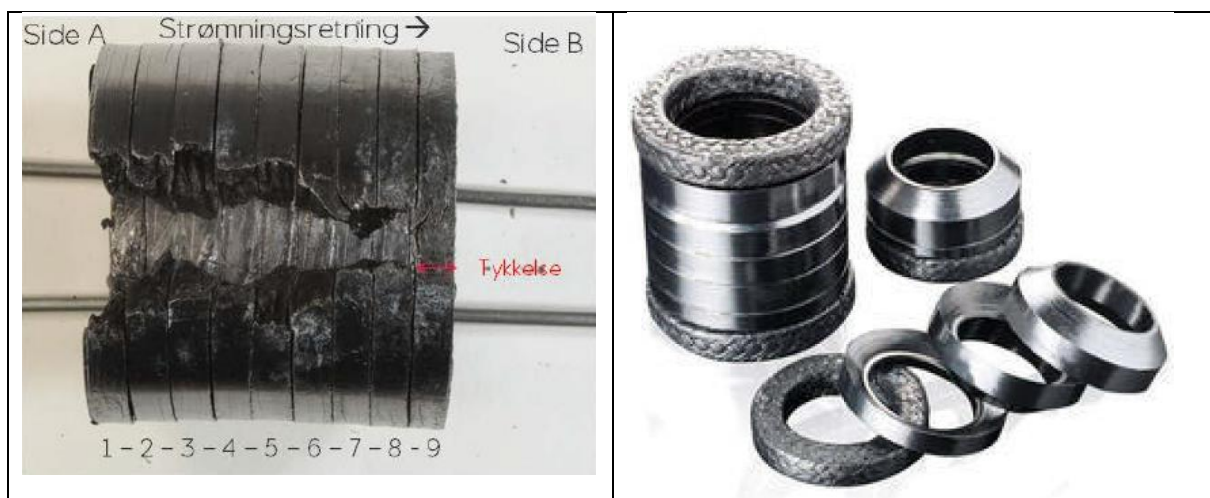


Figure 1 Damaged stuffing box rings. The first and last of these should actually have been braided, like those shown on the right.

Causes

The direct and underlying causes are described below. No single fault has been identified as the cause. Instead, a series of technical faults, design factors, operational practice and organisational conditions led collectively to the incident occurring.

Direct (1-3) and underlying (bullet points) causes

1. The wrong material number was specified in the management system
 - the valve diagram specified only moulded graphite rings and failed to take account of changed requirements for valve and stuffing box

- operational lessons which had led to the conversion of similar valves were not taken into account
 - erroneous connection between tag number and valve type in the management system.¹
2. The valve stem had been bent because of excessive torque
- the valve was due to be opened about a month before the incident in question, but was operated instead against closed
 - the transmission was delivered with a direction of rotation which was the opposite of the normal practice because of space problems for the travelling nut in the transmission
 - the direction of rotation for the valve was incorrectly marked – both opening and closing were marked as clockwise
 - all corresponding valves have the normal direction of rotation.
3. Leak in the stuffing box
- the graphite rings were partially washed out of the stuffing box
 - gas and oil against the stuffing box with a pressure of 310 barg
 - braiding graphite packing rings were not inserted at top and bottom of the stuffing box
 - updated requirements from 2013 specified that a mix of braided and moulded packing rings should be inserted. This was not done.

Lessons learnt and recommendations²

- Use updated requirements when manufacturing replacements for old equipment
 - relate valve data sheet to the correct valve type
 - relate correct packing box to existing valves
 - inform procurement/purchase teams about valve requirements
- Better checks when using the equaliser line
 - install a pressure gauge in the equaliser pipe, which can be read in the central control room
 - create common guidelines on how the equaliser system is to be operated
- Replace stuffing boxes which only contain moulded rings (applies to valves which experience high pressure and are often operated, such as manual valves against the equaliser and gas injection manifold)
- Ensure that equipment taken out of store accords with updated requirements
- When equipment is in store, a note must be attached to explain why the equipment has possibly not been taken into use should a fault be suspected. Update checklists for equipment returns.

¹ If valves are tied to a valve data sheet (VDS) number, the latest updated specifications must be obtained when placing a new order for the valve and associated equipment such as the stuffing box. This will make it possible to pick up the changes to the requirements, which are based in turn on operating experience and incidents.

² Only recommendations related to the leak and which are relevant beyond the facility in question are reproduced here.